


Boundaries of firms and catching up by latecomers in global production networks : the case of a Mexican auto-parts manufacturer

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Boundaries of Firms and Catching Up by Latecomers in Global Production Networks: The Case of a Mexican Auto-Parts Manufacturer

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Abstract

For manufacturing firms in developing countries, there are high barriers to entry and to catching up with competitors in their global production networks (GPNs). This paper examines the case of a Mexican auto-parts manufacturer that succeeded in catching up in the automotive GPN. The author proposes that the door to GPNs is open thanks to frequent changes in the boundaries of firms, and also stresses the importance of the necessary conditions that generate opportunities, including institutional settings that facilitate market entry and catching up, and capability building by firms hopeful of entry.

Keywords: boundary of firms, global production network (GPN), automobile industry, auto-parts, ISI, export industrialization, Mexico, Nemak, Alfa, Ford

JEL classification: L22, L52, L62, N66, N86, O33

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Introduction

The external conditions relevant to catching up for industries and firms in developing countries changed drastically in the 1980s. Previously, industries were organized by country and their markets were found within national borders. Firms made efforts to catch up under the protection of government regulations on imports and inward foreign investment. Since the 1980s such conditions have totally changed. Firms were deprived of protection due to liberalization policies on trade and investment adopted by governments. Some industries which were formerly organized within national borders were reformed and reorganized into global production networks (GPNs). The changes in industrial organization on a global scale obliged firms to redefine catching up strategies in order to secure positions within the newly formed networks. Without the protection of the government and with intensified global competition, it became much more difficult than before for developing country firms to catch up with others already established in global markets.

This paper examines the necessary condition for the catching up of firms in developing countries in GPNs, using the case of the Mexican firm Nemak, an original-equipment manufacturer (OEM) auto parts producer.

The reason for focusing on Nemak is as follows. The automobile industry is one of several industries that experienced changes in industrial organization since the 1980s, from being organized within national borders to being a GPN (Hoffman and Kaplinsky 1988; Langlois and Robertson 1995; Barnes and Kaplinsky 2000; Veloso and Kumar 2002; Humphrey 2003; Lall and Zhang 2004; Wad 2008; Sturgeon, Biesebroeck, and Gereffi 2008). The production of automobiles consists of two sectors, the production of auto parts and their assembly into completed vehicles. Dominating the GPN is a small number of large automobile manufacturers, principally in developed countries. They decide the qualifications required for auto-parts suppliers and coordinate a stratified and globally extended network of suppliers. The qualification for suppliers is highly demanding, and the supply chains are densely populated with developed country firms. The case of Nemak is interesting because this firm is one of a small number of auto-parts suppliers in developing countries that entered the chain as a latecomer and succeeded in catching up to the world's leading producers¹ in its market segment. By

¹ According to *Automotive News* June 17, 2013, Nemak was ranked the 52nd among the top 100 global OEM parts suppliers. Of the top 100 firms, only 8 were based in developing countries. <http://www.autonews.com/assets/PDF/CA89220617.PDF>.(accessed

examining the experience of Nematik, I expect to gain insights into the necessary conditions for other latecomer firms in developing countries to catch up in highly competitive GPNs.

In the catching up process of firms in developing countries, I consider that the following three categories of conditions are important: the condition in general of the industry concerned, the capabilities of the firm concerned, and the institutional settings surrounding the firm. My proposition is that, in the case of Nematik, all three categories of conditions were favorable to the entry and catching up in the automobile GPN.

Concerning the condition of the industry, special mention must be made of the dynamic nature of GPNs, which change over time due to competition among firms and by diffusion of innovation through learning by firms. Firms may get a chance to enter the GPN and to get space in them, thereby changing the composition of the network. This perspective is derived from the theoretical consideration of the boundary of firms.

Langlois and Roberts (1995) propounded why and when a firm's boundaries changes. According to them, firms consist of two distinct but changing parts, the intrinsic core capabilities and the rest of its ancillary capabilities.

“The boundaries of the firm, which are defined as the extent to which ancillary capabilities will be internalized or bought through the market, depend (1) on the strength of the firm's own capabilities relative to those that can be purchased and (2) on the respective transaction and governance costs involved in making or buying the capabilities. Both the intrinsic core and the ancillary capabilities, and the prevailing levels of transaction costs may be expected to change over time because they are underpinned by knowledge (Langlois and Robertson 1995, p. 7). Thus in the long run, the boundaries of the firms may be altered as firms gain experience in the market and GPN.

Although the changes in a firm's boundary may offer it the chance of entry to a GPN, it may not be a sufficient condition. In order to take advantage of a chance to enter a GPN, a firm's own conditions, such as the capability to recognize opportunities and the ability to exert efforts to catch up in the GPN, may also be necessary. Another necessary condition will be institutional settings which enable the firm's capability building.

In the following sections, I will show how and why these three categories of conditions favorably affected the catching up by Nematik.

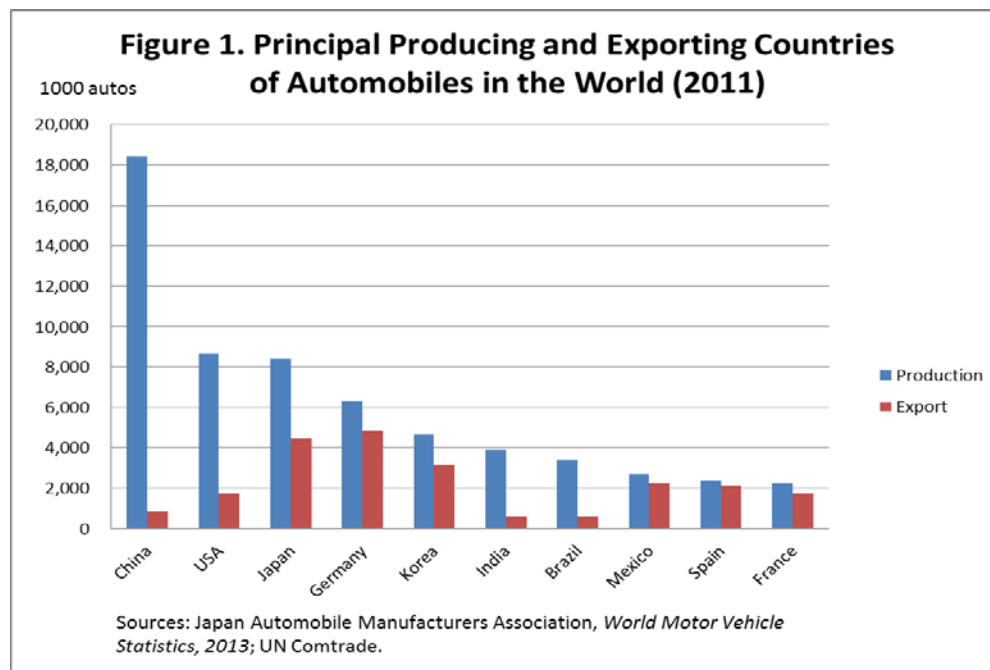
The paper is divided in four parts. In the first section, the focus is on the process of industrial restructuring of the Mexican automobile industry. I will show that in the course of changing institutional settings presented by the Mexican government's industrialization policy from import substitution industrialization (ISI) to export industrialization, a majority of local firms dropped out of the industry and only a limited number of local firms, including NemaK, were able to survive. In the second part, I examine the conditions under which NemaK achieved entry to the automobile GPN. It will be shown that the transition of institutional settings in the 1980s and the preceding growth of Mexican firms with proprietary capabilities favored the entry of NemaK to the GPN. In the third section, the process of NemaK's catching up with global suppliers will be examined. In order to be a global OEM supplier in the automobile industry, the necessary condition is to locate plants in proximity to the major automobile assemblers. I focus on how NemaK could clear this hurdle. In the final section I summarize how and why NemaK caught up to global suppliers, and discuss the necessary conditions for catching up by developing country firms in the GPN, drawing lessons from the experience of NemaK.

I. Dropping Out or Catching Up: Two Trajectories of Local Firms in the Mexican Automobile Industry

1. Development of the Mexican Automobile Industry

As of 2011, Mexico ranked eighth in the world automobile industry in production and fourth in exports. As an automobile producing country, a peculiarity of Mexico is that the majority of assembled cars are exported to the US market, the most competitive market in the world. In contrast, other major developing countries with automobile production such as China, India, and Brazil largely depend on the local markets for the sales of their products, as shown in Figure 1.

The rapid growth of production and export of automobiles in Mexico started at the end of the 1980s. It is possible to divide the development of the Mexican automobile industry into three periods, taking government policy on the automobile industry as benchmarks. The first period, from 1962 to 1976, is the period of ISI. The period after 1989 is the period of export industrialization. The years between 1977 and 1988 can be considered as the period of transition from ISI to export industrialization.



The first period began in 1962 with the issue of the first government decree concerning the automotive industry. Until then foreign and Mexican firms undertook the assembly of automobiles from imported complete knockdown kits, and importation of finished cars was prohibited. The principal points of the new decree were the prohibition of imports of engines and power-train components, locally manufactured content of 60% or more for assembly firms, the prohibition of production of auto parts by assembly firms except for engines and those parts which had been manufactured by assemblers before the 1962 decree, and the restriction to a maximum foreign capital participation of 40% in newly formed auto-parts firms (Hoshino 2001, pp. 100-102). The 1962 decree succeeded in starting a Mexican auto-parts industry with firms having 60% or more Mexican ownership.

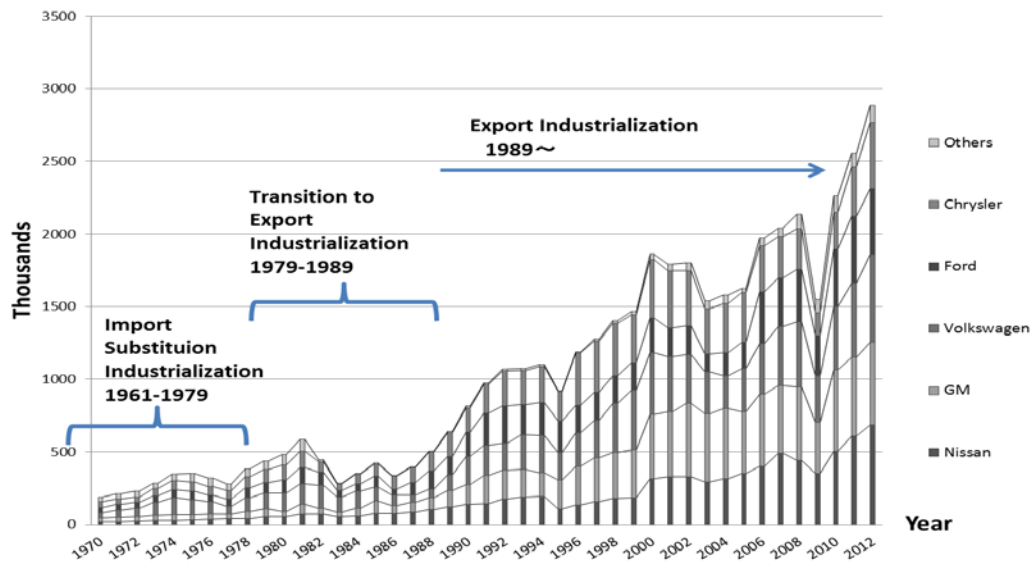
The 1962 decree aimed at import substitution by auto-parts production, but within a few years it began to show its limitations in terms of production efficiency and foreign exchange saving. The inefficiency was caused by the lack of economies of scale because the government could not restrict the number of assemblers and the number of vehicle types and models produced. As for foreign exchange saving, although domestic production of auto-parts brought down the volume of imported parts per vehicle, the volume for the industry as a whole increased as the number of cars produced increased (Hoshino 2001, p.103). The subsequent export promotion policy was expected to resolve these two problems at once.

The second period began with the issue of the decree of 1977, which fostered exports of the automobile industry. Export promotion had already begun with a decree issued in 1972 which obliged assemblers to earn from their own exports a certain percentage of the foreign exchange needed for importing parts, but this did not achieve its intended outcome. To foster the industry's exports, the decree of 1977 obliged assemblers to procure all of the foreign exchange they needed for importing parts through a newly introduced foreign currency rationing system until 1982. Also, at least 50% of assemblers' exports had to have parts from Mexican auto-parts firms (Hoshino 2001, pp. 104-105). In order to induce assemblers to export, various incentives were provided, which will be mentioned in the following section. The period is characterized as transitional because the essential elements of the ISI policy remained in effect until 1989, including prohibition of imports of finished cars, prohibition of auto-parts production by assemblers, national content regulation, and restriction of foreign capital to 40% for newly formed auto-parts firms, although they were relaxed by a decree issued in 1983.

The third period, namely, the period of export industrialization, began with a decree issued in 1989 that lifted the remaining elements of the ISI decrees and resulted in expanded automobile exports. The principal elements of the decree of 1989 were the liberalization of auto-parts procurement by assemblers, the liberalization of auto-parts production by assemblers and foreign-owned auto-parts manufacturers, and the approval of assemblers' imports of finished cars subject to the favorable balance of their exports and imports. The North American Free Trade Agreement (NAFTA) which took effect in 1994 further accelerated the liberalization process. It required abolition of the national contents regulation and also abolition of the obligation of foreign exchange balance by assemblers until 2004 (Serita 2000, p.7-8).

As the restrictions of government regulations were lifted, the assemblers—all of which were based in developed countries—expanded production of vehicles in Mexico. Figure 2 shows that in the ISI period their annual production was less than 400,000 vehicles in total, but in the period of export industrialization the total production expanded fourfold, from 640,000 in 1989 to 2,557,000 in 2012. Mexico in 2011 was in fourth position in the world in automobile exports, so it is safe to conclude that the Mexican automobile industry has succeeded in catching up to the world's principal producing countries in the past three decades.

Figure 2. Production of Passenger Cars and Small Trucks in Mexico by Assemblers



Notes: 1. During 1997-2003, the production of Daimler is included in Chrysler.

2. Others are Honda and Toyota.

3. During 2011-2012, the production of Fiat is included in Chrysler.

Sources: AMIA, *La industria automotriz de Mexico en cifras 1982*/INEGI, *Industria automotriz en México*, 1997, 2001, 2003, 2006, 2009, 2010/ AMIA, *Boletín de prensa*, diciembre 2012.

The catching up of the industry in general is a positive side of the development of the Mexican automobile industry. The negative side of the story was the dropping out of local auto-parts producers in the process.

2. Catching Up of the Industry and Dropout of Local Firms

Before the issue of the decree of 1962, few auto-parts firms existed in Mexico. Due to the decree, in order to continue production the assemblers were forced to help found auto-parts firms. Two types of auto-parts makers were brought into being. One was a small number of large-scale firms producing principal auto-parts; many of which had foreign auto-parts makers as shareholders but with majority shares held by Mexican entrepreneurs. Involved in the establishment of this type of auto-parts firms were the foreign assemblers, which functioned as matchmakers bringing together foreign auto-parts manufacturers and Mexican industrialists. The other type was a large number of small-scale manufacturers producing simple, low-cost parts, most of which were owned 100% by Mexican capital and many beginning production by licensing foreign technology (Bennett and Sharpe 1985, pp. 129-30; Bennett 1986, pp. 18-19).

Thus, during the period of ISI, the main actors in auto-parts production were Mexican local firms. The situation began to change when the Mexican government lifted the regulation on imports of auto-parts and the regulation on investment by foreign firms in auto-parts production. This resulted in many Mexican auto-parts firms dropping out of the industry.

To understand the scale of dropping out, I surveyed the survival rate of Mexican auto-parts firms that were registered in the directories of Mexican auto-parts manufacturers from the year 1986, when there was still regulation of foreign investment. I could confirm the names of 230 firms in two directories for 1986.² Of these 230 firms, only 71 appeared again as auto-parts producers in the 2010 directories.³ This means that 159 firms, or almost 70% of those existing in 1986, disappeared in the sense that they did not exist under the same name in 2010. Another remarkable fact that was observed was changes in ownership in the surviving firms. Of the 71 firms, for at least 25 firms the majority ownership had changed from Mexican to foreign. Data on the ownership for 8 firms were unavailable, and at least 38 firms maintained the majority Mexican ownership. However, of these 38 firms, 7 had changed from being a manufacturer of original equipment to a manufacturer of spare parts. These facts indicate a massive dropping out of Mexican local firms from the production of auto-parts during years from 1986 to 2010.

Although there was massive dropping out of local firms, there were a few exceptional cases of survival and also of catching up, which I focus on in the following section.

3. Catching Up of Local Firms: A Few Exceptional Cases

The dropping out of local firms from auto-parts production was a common phenomenon in developing countries where ISI had been promoted in the automobile

² The directories of 1986 referred to are those issued by the association of Mexican auto-parts producers, or INA (*Directorio de la Industria Nacional de Autopartes*, 1986) and by JETRO (*La Industria automotriz y de autopartes en México*, 1986).

³ The directories of 2010 referred to are those issued by INA (*Directorio de Empresas Autopartes*, 2010) and those by Mercamétrica Ediciones (*Directorio industridada AAA*, 2010, *Directorio industridada AA*, 2010, *Directorio industridada A*, 2010, *Directorio industridada B*, 2010).

industry and a liberalization policy was later adopted.⁴ The proportion of those surviving the changes of institutional settings was smaller in Mexico than in most other developing countries.

The directory of the Mexican auto-parts producers' association, Industria Nacional de Autopartes (INA), for the year 2010 contains the names of 894 firms. Because of the lack of information on ownership of the registered firms in the directory, we cannot know exactly the proportion of local firms in the Mexican auto-parts industry, but a rough estimate of the percentage of foreign firms among auto-parts manufacturers was reported as 70% by Comisión Económica para América Latina y el Caribe (CEPAL) and also by the Mexican Secretariat of Economy (CEPAL 2010; SE 2011).

Compared with other developing countries, the figure of 70% is rather high. The auto-parts producers' association in Brazil reported that firms with 100% foreign capital and those with more than 51% in 2010 accounted for 31% and 8% of the 504 member firms respectively (SINDIPEÇAS and ABIPEÇAS 2011). In the case of Thailand, the president of Thailand Automotive Institute reported that, of the 645 auto-parts firms in the first tier of the supply chain, those with majority foreign ownership was 47% in 2010 (<https://www.asean.or.jp/ja/invest/about/eventreports/2011/2010/20.html> accessed June 2, 2012). Therefore, Mexico has a much smaller percentage of local firms with a majority of locally owned shares than either Brazil or Thailand.

Although it is hard to know the national ownership of firms in general, in the case of first-tier firms the information is relatively easy to access because they are large-scale firms which make more information publicly available. Using the INA directory and other sources, I surveyed the first-tier Mexican firms and identified 46 with majority Mexican ownership. Of these 46 firms, 31 firms are subsidiaries of large Mexican business groups.

The business group is the dominant form of organization of Mexican large-scale firms. In the period of ISI the groups were encouraged to invest in the auto-parts sector, which offered them a foothold for further growth (Hoshino 2001). We can easily see that they still hold space in the sector, even though the dominant actors

⁴ Marginalization of local firms with the advance of auto-parts firms of developed countries and the increased importation of auto parts is analyzed for India and Brazil by Humphrey (2003), for Korea by Wad (2008) and for South Africa by Barnes and Kaplinsky (2000).

are now foreign firms. Table 1 shows nine business groups, to which belong 31 first-tier Mexican auto-parts manufacturers.

It is possible to classify these nine business groups into three categories according to their entry year to the auto-parts sector. The first consists of Proeza, Kuo, Grupo Industrial Saltillo, and Grupo Bocar, which entered the sector in the 1960s during the period of ISI. The second consists of Alfa and Vitro, which entered near the end of the 1970s. Included in the third are Sanluis, Grupo Carso, and Quimmco, which entered the sector by acquisitions in the 1980s and after. These all were survivors of an adverse environment. In the next section I will examine how they survived, by focusing on the case of NemaK, which is the highest ranked global supplier among the subsidiaries of the nine business groups.

Table 1. Principal Mexican First Tier Auto-Parts Suppliers

Name of Business Group	Name of Principal Subsidiaries in Auto-Parts Sector	Principal Products	Group's Entry Year to Auto-Parts Industry	Number of Employees of Auto-Parts Section (2012)
Proeza	Metalsa, Perfektools, Teknik, Novo Cast	light duty frames, space frames, body structures, safety systems, suspension structures, others	1960	about 8,000
Grupo Kuo	Transmisiones Equipos Mecánicos, TF Victor, Pistones Moresa, Fricción y Tecnología, Frenado Automotriz	manual transmission, varios kinds of repair parts	1960	3,506
Grupo Industrial Saltillo	Cifunsa, Tisamatic	grey and nodular iron auto parts for transmission and brake systems, ductile and grey iron castings	1964	2150 ¹
Grupo Bocar	Bocar, Auma, Plastic Tec	precision parts and assemblies, plastic injection-molded-parts, aluminum and zinc die-cast products	1967	about 6,000
Alfa	Nemak, Castech	aluminum cylinder head, aluminum engine block	1979	20,312
Vitro	Vitro Automotriz, Vidrio Plano, Vitro Flex	automotive flat glass	1979	5,839 ²
Sanluis Corporación	Rassini, Rassini Frenos, Bypasa	leaf springs for suspension, rotors, drums, assemblies and brake hubs	1988	4,417
Grupo Carso	Gabriel de México, Arela, Arcomex, Cordaflex, Sealed Power Autopartes	wireharness, cables, shock absorber,	1992	18,500 ³
Quimmco	Quimmco Centro Tecnológico, Manufacturera de Cigüeñales de México, Sistemas Automotrices de México, Forja de Monterrey	axles, brakes, crankshafts and related components	1994	about 5,000

Notes: 1.Estimated employees number of 2008

2.Employees number in flat glass sector.

3.Estimated employees number of Grupo Condumex of 2008.

Sources: Elaborated by Hoshino based on annual reports and information of home page of companies.

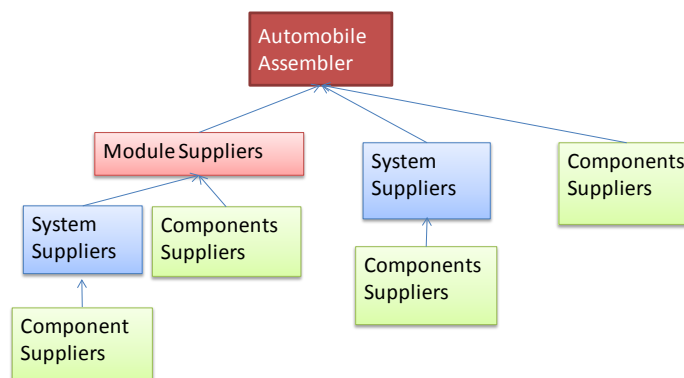
II. Restructuring of the Supply Chain in Mexico and Entry of Nemak to the Auto-Parts Sector

1. Boundary of Firms in the Auto-Parts Industry

To understand the importance of the boundary of firms for examining the entry of Nemak to the auto-parts production, it is necessary to explain how supply chains are organized in the automobile industry.

A passenger car consists of at least 15,000 different parts. For the sake of convenience, I would like to classify them into three categories based on the degree of assembly: components, systems and modules. Components are the simplest level of auto parts. The components are assembled into systems, which have specific functions in the automobile. Systems and components are assembled to make a module, which is a unit of integrated systems⁵. For example, an automotive engine can be considered as a module because it is an integrated complex of functions that are performed by multiple systems. While the assembly of engines is generally done internally in assembly firms, the systems and other major components such as the oil pump, water pump, cylinder head and block, are provided by external suppliers. Figure 3 is a conceptual chart of the supply chain of the automobile industry. Although transactions may occur between suppliers of the same category, they are not indicated in the chart for the sake of simplicity.

Figure 3. Conceptual Chart of Supply Chain of Automobile Industry



Source: Elaborated by Hoshino.

The boundary of firms in the automobile industry in practice is the extent of

⁵ This classification is an idea of this author based on Veloso and Kumar (2002, pp. 12-22).

internal production as opposed to outsourcing needed parts. If we use the conceptual chart, it means where we can draw a boundary line between the assemblers and suppliers, for each category shown in the chart. Locations of boundary lines are not fixed, and can differ by the type of part. The assembly of engines is done internally by assemblers as mentioned above, so that in the case of engines the practical boundary line of the automobile assembler can be drawn below module suppliers in the chart. The locations of boundary lines can also change with time. In the past, the supply chains of Japanese assemblers and US assemblers were very different in the extent of internalization. The extent was much lower among Japanese assemblers than US assemblers, although the difference has now been narrowed because of the externalization of the auto-parts division by US automobile manufacturers due to intensified competition (Shimokawa 1990, p. 80). Another factor that changed the location of the boundary of firms is the changing institutional settings.

2. Change of Institutional Setting and Entry of Mexican Firms to Auto-Parts Production

In the case of the Mexican automobile industry, we can interpret the institutional setting as the government policies represented in various decrees designed to regulate firms in the industry. As discussed previously, government policy changed in the past five decades from ISI to export industrialization, with a period of transition between them. With the changing of institutional settings, the boundaries of firms also changed.

Until the issue of the decree of 1962, the supply chain described in Figure 3 did not exist in Mexico. By the decree, the boundary of assemblers was fixed. They were permitted only the assembly of automobiles and engines and also any auto parts which they had already been manufacturing in Mexico. The space outside of this boundary was reserved for Mexican local firms. System suppliers and components suppliers with more than 60% Mexican ownership were then founded and the creation of the supply chain was started. Proeza, Grupo Kuo, and Grupo Industrial Saltillo entered the auto-parts sector, taking advantage of the new institutional setting.

Another change in the boundary of firms was the extension of system suppliers' boundary to the production of components. This was promoted by the decree of 1972, which extended the national contents regulation to auto-parts firms. Because of the lack of components suppliers, system suppliers had to internalize the production of needed

components in order to raise the percentage of national content in their products (Hoshino 2001, p. 111).

In the transition period from 1977 to 1989, the change of institutional setting affected the boundary of firms in two ways. One way was by the obligation of assemblers' self-procurement of foreign exchange needed for imports. This requirement could be met by increasing the local procurement of auto parts and thereby decrease total imports, which opened chances for new entries to the sub-sector and led to the second wave of entry to the auto parts sector by Mexican business groups. Another way to meet the foreign exchange requirement was to increase exports, which offered additional opportunities for entry to Mexican firms. Nemak entered the auto-parts sector by using the opportunity offered by the assemblers' efforts to increase exports. In the following section, the case of Nemak will be examined.

Another change of institutional setting, which took place outside of the automobile industry, was the government promotion of *maquiladoras*, as the factories of the in-bond manufacturing industry are called. In order to improve the foreign exchange balance, the Mexican government permitted the establishment of firms with 100% foreign capital and exemption of import duty on equipment and materials, under the condition that all products were to be exported. This was an exception to the 1973 foreign investment law which restricted the participation of foreign capital in newly established firms to no more than 49%. Foreign automobile manufacturers and auto-parts firms began to establish subsidiaries that produced auto parts in the *maquiladoras* during the transition period (Zapata, Hoshino and Hanono 1990, p.26). All of these products were exported, so the *maquiladoras* were not integrated with the existing supply chain in Mexico during that period. The boundary of the assemblers in Mexico could not extend to *maquiladora* auto parts production, so the two subsectors functioned separately. During the period of the export industrialization the *maquiladoras* became integrated with the supply chain in Mexico.

In the period of the export industrialization, the drastic change in the institutional setting brought about changes in the boundaries of assemblers and auto-parts firms. By the liberalization of auto-parts procurement by assemblers, and the liberalization of auto-parts production by assemblers and foreign auto-parts manufacturers, the space reserved for local firms in the auto-parts sector was eliminated. With increased auto-parts imports and increased investment by assemblers and foreign auto-parts manufacturers, the assemblers changed their boundaries. The boundary of assemblers was extended to the auto-parts sector by integrating the *maquiladoras* within

the supply chain, by acquiring existing auto-parts firms, and by investing in newly established auto-parts firms.

With regard to the auto-parts manufacturers, 70% of Mexican auto-parts firms existing in 1986 ceased to exist, as discussed earlier. Some of the surviving Mexican auto-parts firms extended their boundaries by acquiring the assets of firms that had closed, and some newly emerged business groups such as Grupo Carso and Sanluis entered the sector by acquiring the business of the closed firms (Hoshino 1996, p.44, p.52). Whether surviving or newly entered, they ceased to be dominant actors in the auto-parts sector. The dominant actors were now the foreign auto-parts manufacturers that entered Mexico by acquiring the assets of extinct firms, by investing in new subsidiaries, or by switching from the *maquiladoras* and integrating to the restructured Mexican supply chain.

3. The Transition Period: Good Timing of Entry by Nemak

Nemak was established in 1979 as a joint venture of 75% by Alfa, a Mexican business group, and 25% by Ford for the production of aluminum cylinder heads for automobile engines.

The establishment of Nemak was a response by Ford to the decree of 1977. The decree obliged the assemblers to earn by exports the foreign exchange needed for imports. The assemblers responded in the same way, by exporting engines to the US market. For that purpose, they invested a huge amount of money in new engine plants. All five principal assemblers constructed new plants in the years between 1978 and 1983 (Arteaga 1992, pp. 33-35). As a result, the capacity of production expanded to 2,081,000 engines in 1983, while their production of passenger cars in the same year was only 210,000 (Studer-Noguez 2002, pp. 342-343). Another obligation of the 1977 decree was that at least 50% of assemblers' exports had to have parts from Mexican auto-parts firms. The restriction on foreign capital participation in auto-parts firms was still in effect during the period of transition, so the assemblers were forced to find, or to start themselves, local firms with the ability to manufacture auto parts of high enough quality to export to the US market. Nemak was founded to meet this need.

Ford selected Alfa as a project partner because it was considered the best Mexican alternative at that time due to its reputation based on technological capability, financial resources, and experience with joint ventures. The group was founded in 1974 but its antecedent dates back to Cervecería Cuautémoc, a brewery founded in

1890. In the course of its development, the beer company diversified into industries such as glass, iron and steel, paper, chemical, petrochemical, and finance. The group as a whole was known as the Monterrey Group after the location of its headquarters. Monterrey Group was separated into four groups afterward, and Alfa was formed in 1974 by taking the iron and steel and the paper business from Monterrey Group. Other groups spun off of the Monterrey Group were Vitro, FEMSA (formerly VISA) and Cydsa (Hoshino 1993, pp. 513-516)⁶.

Alfa was a worthy project partner of Ford due to its reputation of technological capability in metalworking. Its iron and steel business, which was under a subsidiary named Hylsa, was founded in 1943 to produce the steel used to make beer bottle caps. When the imports of rolled steel from the US were suspended during World War II, the company succeeded in developing an innovative direct reduction method of steelmaking which was recognized worldwide (Hoshino 2001, p. 48).

Around the year of Nemak's foundation, Ford also started other two joint ventures, with Vitro for producing automotive glass, and with FEMSA for making auto parts by plastic injection. Though Vitro still is in business, FEMSA sold it due to the external debt problem in the 1980s. Ford also divested from both businesses in the process of externalizing their auto-parts division, which will be discussed in the following section.

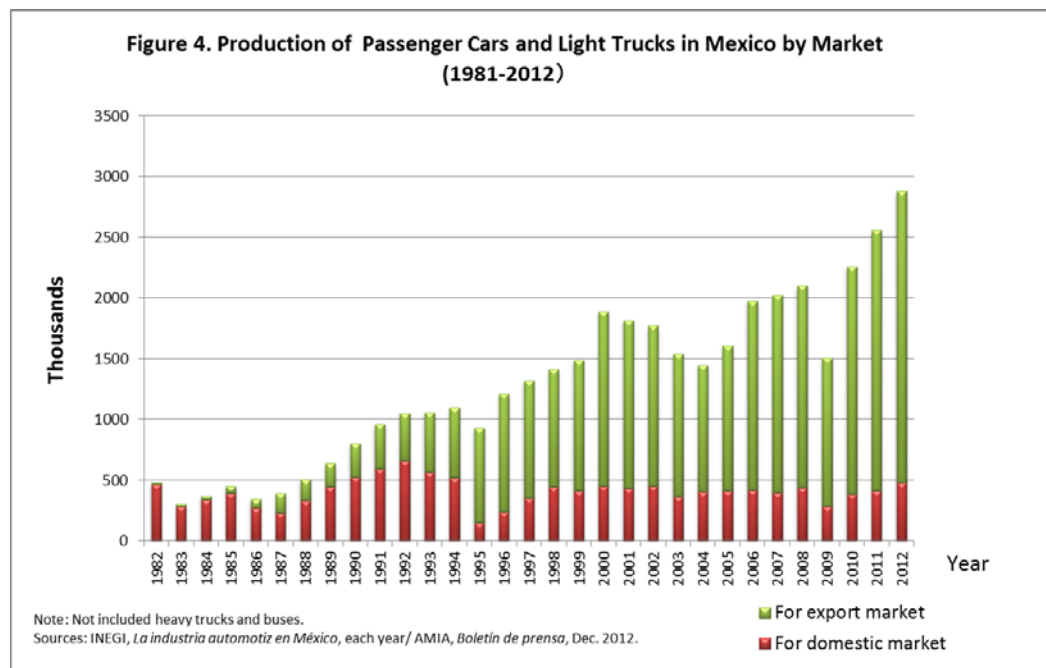
Nemak's yearly sales volume was in the range of 700,000 to 900,000 pieces during the 1984-1987 period. In 1988 it experienced significant growth to 1.5 million pieces, with the majority of the production exported. Around 40% of the production was exported directly to Ford's engine plant in Canada and the rest was indirectly exported to the US market after being assembled into engines and finished automobiles. Although Ford participated in Nemak's capital, its market was not limited to Ford but also included GM and Chrysler.⁷

The export of cylinder heads by Nemak increased rapidly in the 1980s. In the background was the external debt crisis that began in 1982. When Nemak was founded in 1979, the advantage of producing engines in Mexico was small considering the transportation cost. The principal reason why assemblers accepted the requirement of the decree was to secure the Mexican market, which was expanding under the economic

⁶ In a 1972 study of principal Mexican business groups, Alfa was listed in first place (Cordero and Santin 1977, 29).

⁷ Nissan and Volkswagen produced their own engine cylinder heads. Information is taken from the interview carried out in the plant of Nemak in October, 1989.

boom triggered by petroleum exports.



Conditions suddenly changed due to the large-scale devaluation of the peso caused by Mexico's external debt crisis. With the drastic improvement of cost competitiveness, Mexico obtained comparative advantage as a production site within the North American market (Studer-Noguez 2002, p.174). Figure 4 shows that exports of finished cars started in the mid-1980s. This increase was also affected by a dynamic in the US market which will be discussed in a later section.

Compared with the Mexican domestic market, the export market and especially the US market are more demanding with regard to quality, price, and delivery time. How did Mexican firms improve their capability to fill the gap?

3. Capability Improvement of Mexican Firms in the Transition Period

Production of aluminum cylinder heads consists of melting aluminum scrap, casting the molten metal in a mold, and finishing by machine. Nemak adopted a process based on gravity casting in a semi-permanent mold. When Nemak started business, they contracted technological assistance from Teskid, an Italian firm recognized as one of the world leaders in this casting technology. In 1989 Teskid joined the venture with 20% capital participation, lowering the shares of Alfa and Ford to 60% and 20% respectively. Teskid withdrew fully from Nemak by 2000 at the latest but it can be assumed that the

period of Teskid's capital participation was when Nema's technological knowledge advanced most. At the same time Nema also improved its capabilities by introducing a quality control system and a 'just in time' logistics system, training operating personnel, and recruiting engineers of higher educational level. Ford pushed the process along by demanding higher level of performance and at the same time by encouraging performance by means of recognition and awards for quality⁸.

The experience of Nema was not exceptional. Zapata, Hoshino, and Hanono (1990) report the restructuring process of 12 auto-parts subsidiaries of seven Mexican business groups, pointing out the following findings. Firstly, after the external debt crisis of 1982, the firms seriously tackled the restructuring of their export-oriented business. Their seriousness was derived from two circumstances. They could not help but fight their way forward by exports due to the depressed domestic market, and because most business groups had a problem of huge external debts contracted during the economic boom and urgently needed foreign exchange to survive. Alfa was in this same situation. Secondly, foreign auto-parts firms generally participated as minority shareholders in the subsidiaries of business groups, so they could expect assistance from the foreign partners with respect to technology and market development. They also influenced auto-parts firms to improve their capabilities by pressure and encouragement, as seen in the case of Nema. In the 1980s, the restriction on foreign capital participation was still in effect, so it was a unique and last chance for Mexican firms to make rapid major advances in capabilities under a protective institutional setting.

III. Restructuring of the North American Supply Chain and Catching Up of Nema

1. Competition and Changing Boundary of Firms

The rapid increase of Mexican automobile exports was affected by dynamic influences coming from two directions. As has been described, the first force was the change of industrial development strategy of the Mexican government from ISI to export industrialization. Another originated from the intensified competition in the US automobile market caused by the emergence of Japanese vehicle imports.

⁸ Source of information is same as footnote 7.

In the 1970s, consumer preferences in the US market shifted from large-sized vehicles to smaller-sized ones because of the oil shocks that greatly increased international petroleum prices, which also led to a US government mandate for higher automobile fuel efficiency in 1978. The US automobile manufacturers, who had specialized in producing large-sized vehicles, failed to adapt successfully to the changed conditions. Japanese automobile manufacturers were able to take advantage of this situation to penetrate the US market because they focused on high-quality smaller vehicles and had improved price competitiveness by means of innovative 'lean production' systems. Japanese auto exports increased rapidly in the 1970s (Shimokawa 1985, pp.63-64; Shimokawa 1990, p.69) .

One pillar of business restructuring by US automobile manufacturers to regain competitiveness was to integrate Mexico into the network of North American automobile production, taking advantage of the lower labor costs. The massive investment in engine plants in Mexico from the end of the 1970s was a part of this strategy. However, before the external debt crisis of 1982, the institutional setting in Mexico was not yet suited for exports. It was the issue of the 1983 decree that helped establish conditions in Mexico for increased exports.

In the 1980s the competition among automobile manufacturers in the US market intensified due to Japanese investments in local production. The investment started in order to evade the voluntary restriction of vehicle exports agreed between the US and the Japanese governments in 1981. Faced with the intensification of competition, the US automobile manufacturers began restructuring. This affected Mexico in the following ways.

Firstly they adopted a new strategy of making Mexico the production site of newly designed smaller vehicles, and of engines and labor-intensive auto-parts for the North American market. For that purpose they expanded their investments in Mexico. To cope with their move, Volkswagen and Nissan also expanded investment in Mexico⁹.

Secondly, US assemblers began to separate their auto-parts divisions and increased outsourcing from auto-parts suppliers in order to concentrate on the development of vehicles and on their assembly, which is the highest value-added process in automobile production. Among auto-parts firms, the concentration of

⁹ Expansion of assemblers' investment in Mexico is analyzed for GM by Carrillo (2004), for Ford by Studer-Noguez (2000), for VW and German auto-parts suppliers by Carrillo and González (1999) and for Nissan by Rodríguez (1992).

production proceeded (Sturgeon, Biesebroeck and Gereffi 2008, p.305)¹⁰. Competition among firms was an important factor in changing the boundary of firms in the automobile industry. Catching up of Nemak to global auto-parts suppliers was achieved by taking advantage of opportunities that emerged as boundaries changed.

2. Requisites of Global Suppliers and the Strategy of Nemak

In the trajectory of catching up of Nemak, it is possible to point out two important steps which enabled the firm to acquire indispensable capabilities required by global auto-parts suppliers. The first step was its acquisition in 2000 of Ford's Canadian aluminum foundry plant for cylinder heads and engine blocks. The second step was a series of acquisitions starting in 2005 of aluminum foundry firms outside of the North American continent.

The first step is important in the sense that by this acquisition Nemak assured its position as a first-tier supplier of its products in the North American production networks of the US big three automobile manufacturers. Since the 1980s the changeover of engine material from iron to aluminum occurred in the global automobile industry to achieve vehicle weight reduction for better fuel efficiency. Ford's divested Canadian plants opened in 1994. From the second half of the 1990s Ford adopted the strategy of outsourcing auto-parts, and in 1997 its auto-parts division had been spun off as a separate auto-parts company Visteon. The separation of Ford's Canadian plants took place under the same strategy. In spite of the capital participation of Ford, Nemak's market was not limited to Ford but also included Chrysler and GM.¹¹ Nemak became a major North American regional supplier of aluminum engine parts by taking advantage of the business restructuring of automobile manufacturers and by focusing on the niche space that had emerged in the network.

In 2005 Nemak started making acquisitions outside of the North American continent. It proceeded by in 2005 acquiring Rautenbach Guss, a German manufacturer of aluminum cylinder heads which had plants in Germany and Slovakia and supplied Volkswagen, Daimler and Porsche. In 2007 Nemak acquired the aluminum foundries of

¹⁰ On the concentration of production among auto-parts firms, there are case studies on Delphi by Lara and Carrillo (2000), on Packard Electric and Delphi by Lara (2002) and on Lear Corporation by Lara, Turjano and Garcia-Garnica (2005).

¹¹ Annual report of Alfa for the year 2005 reports the distribution of sales by clients as follows; Ford 52%, Chrysler (then Daimler Chrysler) 20%, and GM 14% (Alfa, *Informe anual 2006*, p. 23).

Hydro Aluminum Casting, a Norwegian firm whose plants were located in Austria, Germany and Hungary and supplied cylinder heads and blocks to Audi, BMW, Daimler, Ford and Opel. In the same year it also acquired foundry plants of TK Aluminum located in Mexico, the US, China, Poland, Brazil and Argentina. This firm was formerly Teskid, the initial joint venture partner that provided the technological assistance to Nemak. By this acquisition Nissan, Hyundai, Toyota, Fiat, and Peugeot SA were added as clients. In 2012 Nemak acquired J. L. French Automotive Casting, a US manufacturer of transmission and engine castings with plants in the US and Spain providing first-tier global system suppliers such as Magna and ZF. Apart from these acquisitions, Nemak invested in new plants in 2003 in the Czech Republic, and in 2010 and 2012 in India and China respectively, in order to supply Ford's local plants¹².

The acquisitions and the investment in new plants were important to Nemak for raising its position from North American regional supplier to global supplier. Its importance derives from the following characteristics of transactions between assemblers and suppliers in the GPN. Firstly, the production networks of automobile manufacturers and assemblers extend globally, but assemblers require first-tier suppliers to locate their technology centers and production plants nearby in order to reduce the lead time in development and production, and to respond quickly to requests for any modification of products which is needed to adapt to local market requirements. Plants near principal locations of automobile production in the world are indispensable for global first-tier suppliers (Sturgeon, Biesebroeck and Gereffi 2008, p.303). Secondly, due to the increasing outsourcing of auto parts by automobile manufacturers, first-tier suppliers are likely to engage in design and development of auto parts. As a result, the relationship between assemblers and first-tier suppliers became closer than before. It is difficult for latecomers to enter into a supply chain which is linked by close relationships. One of the effective ways to enter the chain was to internalize the relationship itself by acquisition.

Acquisitions also provided Nemak with other benefits. Nemak could upgrade its capability by absorbing technology from leaders in technology such as Teskid. Another benefit was reduction of dependence on Ford for capital and market for its products. In the process of globalization of the business, Ford's share in ownership in Nemak was reduced from 20% in 2004 to 6.76% in 2012. This suggests that expenses of

¹² Information on the acquisitions by Nemak is taken from the annual report (*Reporte anual*) of Alfa submitted to the Mexican Stock Exchange (Bolsa Mexicana de Valores) from the year 2002 to 2012.

the acquisition and the construction of new plants were borne mainly by Alfa. In the total sales of Alfa, Ford's share dropped from 52% in 2005 to 33% in 2012 including sales to Ford Europe. Nemak's list of clients was widely diversified by 2012.¹³

3. Catching Up of Nemak and Alfa's Competitive Asset

The strategy of Nemak for catching up to the global suppliers was planned and implemented under the auspices of Alfa. In the final part of this section, I consider what the role of Nemak is in the business strategy of Alfa, and how Nemak's success in catching up is related to characteristics of Alfa as a business group. It will help to understand why firms that survived changing institutional settings were mainly subsidiaries of business groups.

Alfa is a diversified business group with interests by 2012 in petrochemicals, foods, auto parts, and telecommunication, and has recently begun exploration for natural gas and petroleum. Although Alfa has been a diversified business group from its inception, since 2000 two changes can be observed in its diversification. Firstly, the range of business was narrowed to a smaller number of selected industries, with the first four of the above-mentioned industries remaining as the pillars of the group. In the process of selection, even the iron and steel business which had been considered the group's symbol, was cut off from Alfa due to the heavy debt burden. Secondly, as in the case of auto-parts, Alfa also began overseas expansion by acquisitions in the petrochemical and food sectors. As a result, Alfa's subsidiaries in these industries have grown into leading firms in the North American market (Hoshino 2013, p. 190).

The business group is a typical way large firms are organized in countries that industrialized late (Hikino, Colpan, and Lincoln 2012). One of its frequently observed characteristics is diversification into technologically unrelated industries. Amsden and Hikino (1994) identified project execution capability acquired through repeated entries to new industries as a competitive asset of business group. They stressed that, in the growth of business groups, the knowledge gained through entries to new projects was accumulated and shared within the group, serving as competitive edges for cost reduction and efficiency, and as bases for improving production and innovation

¹³ The annual report of Nemak for the year 2012 reports the distribution of sales by clients as follows: Ford 33% (including Ford Europe), GM (including Shanghai GM and GM Opel) 21%, Chrysler 11%, Volkswagen 6%, BMW 5%, Hyundai-Kia 4%, Nissan 3%, Audi 2%, Renault 2%, Fiat 2%, Daimler 1% and others (Tenedora Nemak, *Reporte anual 2012*, p. 52).

capabilities. At the same time, the imperfect market conditions of late industrialization justified the strategy of diversification.

Alfa's business is no longer confined to the imperfect market of its homeland, so that the diversification strategy loses some justification. However, I consider that diversification still has following advantage for Alfa. Since the diversified businesses of Alfa are loosely connected, it is still true that the knowledge gained in each sector is accumulated as a group resource to be shared among its various sectors. The flexible connections between sectors is observable, for example, in the promotion of managers and directors who move within the group's internal labor market and cross over to different sectors¹⁴. In the sense that Alfa tries to make a competitive asset from the loosely connected but unrelated diversified businesses, the actual strategy is inherited from the past. An important difference from the past is that the selection of businesses is more rational and focused, and that capabilities of each business sector are upgraded to a level of competing with global players, as the case of Nemark shows.

Concluding Remarks

The catching up of Nemark to the forerunners in the automotive GPN was favorably affected by three kinds of condition; the changing boundaries of the firms in the automobile industry, the changing institutional settings represented by the Mexican government's development strategy, and the proprietary capabilities of Nemark and its parent company Alfa.

Alfa's entry to the auto-parts sector and the acquisition of knowledge necessary for efficient production was made under the institutional setting of the transition of the development policy from ISI to export industrialization. The setting of the transition favored Alfa because it created a space for local firms by limiting assemblers' boundaries to a restricted area and also because it encouraged assemblers to assist local firms to improve their capabilities by imposing the obligation of auto-parts exportation. Thus Alfa could acquire a niche space in the production network and the technological knowledge necessary from two joint venture partners, Ford and Teskid.

The next step of Nemark in the catching up to global suppliers in its market segment was overseas expansion, first to North America and afterward outside of North

¹⁴ Promotion of manager crossing over to different sectors of the group is evidenced by the career records of principal managers in the annual reports submitted to the Mexican Stock Exchange.

America. The change of the boundaries of assemblers favorably affected this process. As a part of the restructuring made necessary by competition among automobile manufacturers, Ford separated its asset and transferred it to NemaK, strengthening NemaK's position as a North American regional supplier. The final step in the catching up of NemaK was through acquisitions made outside of North America. The acquisitions made it possible for NemaK to locate its plants near the principal automobile manufacturers and assemblers, fulfilling this requirement to be a global supplier.

The indispensable condition in all these steps was the capabilities NemaK and its parent company Alfa had for recognizing business opportunities and for project execution, absorption of knowledge, improving production, and innovation.

It can be said that the catching up of NemaK is a success story of a unique firm that had the capabilities to take advantage of unique situations in the past, namely of the favorable coincidence of the institutional setting and business opportunities in the industry. In this sense, the trajectory of NemaK will not be possible to repeat. But even so, I think that we can learn several lessons from the case of NemaK.

Firstly, the boundaries of firms in the GPNs often change due to competition among firms and learning by firms, so that the doors are not closed for latecomers. In this paper I focused on the transactions between automobile manufacturers and first-tier suppliers of the automobile industry, where the highest level of capabilities is required for the entry. However, even in the automobile industry, the changeable boundaries are not limited to those between assemblers and the first-tier suppliers, but exist everywhere in the stratified structure of the supply chain. The required capabilities are different according to the location within the structure, so that different kinds of doors for entry can exist. For firms hopeful of entry to the chain, the first step should be the search for an entry door that matches its capabilities.

Secondly, between the hopeful entrants and the forerunners in the production network, there exist gaps in their level of knowledge. Hopeful entrants can catch up through learning. In the period of ISI, the government regulation served as the institutional setting that encouraged transfer of knowledge from foreign firms to local firms and NemaK was a beneficiary of the ISI policy. In this sense the former ISI policy did affect the level of capabilities of Mexican firms. In the era of globalization, government regulation has lost its efficiency and justification, especially in the GPN, so other kinds of institutional settings which help the entry and the catching up of local firms are needed. The role of government is still important in this respect.

Thirdly, although the existence of doors to entry and favorable institutional

settings are necessary conditions for the entry and the catching up of local firms in the GPN, the most important and indispensable condition is the will and the efforts for capability building by firms. Without it, the success story will never start.

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